Policy and Legal Implications of Sea-based Satellite Launches

This article addresses policy and law issues that pertain to sea-based Space launches. Sea-based Space launch is a relatively new endeavor; accordingly, existing Space policy and/or law provisions have until very recently been inapplicable. Nonetheless, the policies and laws that govern commercial Space launches, including the Outer Space Treaty, Federal Aviation Administration licensing procedures and the Liability Convention, do apply to sea-based launches; it is within this framework that such activities must operate. This article describes the benefits of sea-based Space launch, the market inducements for less expensive Space launches, and the future of commercial Space activities based on the successes of Sea Launch.

By LTC Jorge Rangel

The history of Space law is one that "has developed as required to resolve the problems of the time. Since Space activities have been predominately governmental activities to date, most Space law is public law," (Collins, 1992, pg. 1). This paper addresses policy and legal issues that pertain to sea-based Space launches. Sea-based Space launch is a relatively new endeavor that has not previously been subject to specific policy or law. Even so, many policy issues exist which directly relate to this new venture, to include policies relating to the commercialization of Space, policies deriving from the provisions of the Outer Space Treaty (OST), policies mandated through the Federal Aviation Administration (FAA) launch licensing requirements and policies implementing provisions of the Liability Convention. The main focus of this article will be to examine each of these areas on its own merits, but such an examination would be fruitless without a foundational understanding of the market within which Sea Launch exists. Once this foundation has been laid, the policies and international law governing Sea Launch will have the context necessary to be understandable.

This market arose purely from commercial demand. Space launches are currently the most expensive segment for lifting satellites into orbit that can sometimes account for nearly 30 percent of a mission's cost (Sellers, 2004, pg. 612). The very high cost of launch has resulted in a very limited scope of commercial Space activities to date. The future growth rate of commercial Space activities will depend on how fast and how far launch costs fall (Collins, 1992, pg.1). Clearly, the greatest obstacle to widespread commercial use of Space is launch costs.

Space launch involves a number of associated subsystems, all of which contribute to these costs: The launch site and its associated range, the launch pad, payload and vehicle processing facilities and launch operation centers are the systems that make up the launch segment (Sellers, 2004, pg. 612). With launch costs so high, any system providing a competitive edge in the launch phase deserves industry attention.

Sea launches provide that edge. Sea launches have proven to be an especially promising alternative to terrestrial launches for geostationary (GEO) orbiting communication satellites. Sea launch integrates the best Space and technology assets of nations and corporations to support a single Space segment: launch. As the British Broadcasting Corporation (BBC) put it, "The mission could herald a new era in the Space business as it is designed to cut the cost of launching commercial satellites." (BBC commentary on Sea Launch's launch of a test payload, March 27, 1999, http://news.bbcco.uk/1/hi/sci/tech/306014.stm).

Sea Launch is an international commercial partnership among American, Russian, Ukrainian and Norwegian business entities that lowers cost by taking advantage of the many commercial and Sea Launch attributes that are shown in Figure 1.

This launch cost reduction, along with the increased demand for satellite launches from the information technology industry, will fuel demand for Sea Launch capability for some time to come. However, with this demand arises the need for laws governing and policies guiding the use of such capability. These laws — at least from a commercial Space launch perspective — concern GEO satellites:

"The importance of outer Space to communications law stems from the use of satellites (almost exclusively in geosynchronous orbit) as relays for communications from one point on earth to another, a use first proposed by Arthur C. Clarke in his

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Commercial and sea launch attributes.

- Competition from the commercial sector (prior to 1981 all launches were conducted by the federal government)
- Equatorial positioning for increased velocity, lowering fuel requirements
- Increased orbital placement accuracy, resulting in reduced fuel consumption for final on-orbit maneuvering
- Increased operational life span, resulting from launch-gained fuel reductions that provide more maneuvering fuel to the satellite (i.e., fuel that has been used previously for launch may now be used for station keeping)
- Reduced liability and safety concerns by launching from the open sea
- All-inclination launch capability (inherent in an equatorial launch)
- Synergy gained through an international consortium, which also provides an enhanced infrastructure not achievable by any single consortium partner

Figure 1

famous Wireless World article of October 1945" (Reynolds & Merges, 1997, pg. 215).

As with all other commercial ventures, money drives everything in the satellite industry. In 1996, telecommunications-fixed and mobile satellite services, direct-to-home television revenues were $9 billion and indirect revenues from satellite cable distribution and telephony were about $13 billion (Johnson, Page & Gabbard, 1998, pg. 67). Accordingly, huge incentives exist for a state, business or corporation to compete for an increase in the market share for Space launches, especially in light of the current and future satellite communication requirements previously discussed.

These incentives become magnified when the discussion of Space launch turns specifically to GEO orbits. These orbits are those whose satellites must travel the greatest distance from the Earth and thus require more fuel per unit mass. This increase directly translates to greater costs per pound of satellite (payload and bus) being launched. The radial velocity at the equator is greater than at other latitudes (much like a compact disk's velocity at its rim is greater than at its center), thus providing higher true launch velocities than those from similar launches at higher (northern or southern) latitudes. As explained by a commentator on BBC on March 27, 1999, "This means the rocket can harness maximum benefit from the earth's rotation, which helps catapult the payload into Space." (http://news.bbc.co.uk/1/hi/sci/tech/306014.stm). Consequently, the Earth's geography may be exploited through equatorial launches.

However, commercial equatorial launch capability has previously been a rare find. Although commercial terrestrial launch sites exist in South America, such as in Brazil and French Guiana, the air-land-sea transport of large rockets needed for heavy lift into geosynchronous orbits results in enormous transportation costs. Sea-based launches provide both transports over and launch from sea via the same platform. The concept was first embodied in Sea Launch, a purely commercial venture that provides heavy lift launch service from the open sea. Although the technology for such a service has existed for some time, it has not been available until relatively recently.

The reason for this lack of availability is that until 1981 all U.S. Space launches were executed by the federal government, under supervision of the National Aeronautics and Space Administration (NASA). Many Space laws were developed concurrently with (and to resolve) the "problems of the time." One such problem surfaced in 1981, when a U.S. corporation, Space Services, Inc., announced plans to launch a rocket off the coast of Texas. This announcement created the need for Space law — U.S. commercial Space law in this case — to address the changing landscape of the commercial Space industry. This resulted in the passage of the Commercial Space Launch Act of 1984. This act was developed by Congress to provide minimum federal regulation to:

- Ensure U.S. compliance with treaty obligations (specifically, the Outer Space Treaty).
- Protect public health and safety.
- Provide for safety of property.
- Meet U.S. national security interests.
- Meet U.S. foreign policy objectives.
- Ensure U.S. competitiveness in Space launch.
- Encourage participation by the states.
- Encourage commercial participation in Space (Carver, 24 Feb 05 class notes).

Through the Commercial Space Launch Act, Congress would provide authorization and continual supervision of commercial Space activities through FAA launch licensing requirements for commercial launches, consistent with U.S. treaty obligations listed in Article VI of the Outer Space Treaty. This article provides that sovereign states have an international responsibility for their activities in outer Space, whether such activities are conducted by governmental or by nongovernmental agencies. States also have an

(See Space Law, page 58)

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obligation to ensure that all national activities are conducted consistent with the Outer Space Treaty: "The activities of non-governmental entities in outer Space shall require continuing supervision by the appropriate state" (Reynolds, Merges, 1997, pg. 64-65). It is clear from this language that all Space activities — governmental, commercial or private — are ultimately the responsibility of the state. Another U.S. commercial Space law, the 1998 Commercial Space Act, was designed to encourage international and private economic funding for the development of the International Space Station (Carver, 24 Feb 05).

Sea Launch became possible only through passage of such legislation. This consortium harnesses the proven capabilities of each partner in its particular areas of Space and sea-faring expertise:

- U.S. Boeing — payload fairing, analytical/physical Spacecraft engineering and mission operations.
- Russia RSC Energia — upper stage; launch vehicle integration, ground systems and launch operations.
- Ukraine SDO Yuzhnoye/PO Yuzhmash — two stages of Zenit-3SL, vehicle integration support and launch operations support.
- Norway Kvaener ASA — Odyssey launch platform and the Sea Launch Command Ship (Korn, Feb 05, www.sea-launch.com).

The success of this partnership is evident from the milestones and accomplishments that Sea Launch has secured from the start:

- 1993 — First studies.
- April 3, 1995 — Sea Launch venture formed.
- December 1995 — Ship construction commenced.
- December 18, 1995 — First order signed with Hughes Space and Communications.
- 1998 — Vessels arrive at home port.
- March 27, 1999 — Demonstration payload.
- October 9, 1999 — First commercial launch – DIRECTV 1-R, October 9.
- 2000 — Heaviest commercial payload in history.
- March 18, 2001 — Most powerful commercial payload (XM-ROCK).
- May 8, 2001 — XM constellation completed.
- June 15, 2002 — PanAmSat's Fleet Modernization Program completed.
- May 4, 2004 — Heaviest commercial payload (as of launch date) (http://www.sea-launch.com/why_sea_launch.htm).

This commercial venture went from research and development to its first commercial launch in just six years. This remarkable accomplishment by a commercial Space launch enterprise validated President Reagan's vision to encourage the commercial use of outer Space: "For this vision of the future to become a reality, many advocates of Space believe that the commercialization of Space development is a necessity," (Rowland, 1990, pg. 45).

This rapid ideas-to-action operation would have been impossible but for the commercial Space laws discussed earlier. Chartered to oversee licensing of Space launches under the first of these laws (the Commercial Space Launch Act of 1984), the FAA's Office of the Associate Administrator for Commercial Space Transportation (AST) has responsibility for licensing commercial Space launches, the re-entry of reentry vehicles, and the operation of launch and re-entry sites (Federal Aviation Administration, 1999, p. 1). A launch license granted from FAA/AST authorizes the "licensee to conduct launches from one launch site, within range of launch parameters, of launch vehicles from the same family of vehicles transporting specified classes of payloads. A launch operator license remains in effect for five years from the date of issuance," (http://ast.faa.gov/licensing/intro.html).

The process for obtaining an FAA launch license consists of the following:

- Policy review and approval.
- Safety review and approval.
- Payload review and determination.
- Financial responsibility determination.
- Environmental review (environmental impact statement).
- Compliance monitoring (http://ast.faa.gov/licensing/intro.html).

The U.S. interest in Sea Launch of 40 percent is the largest percentage within the consortium. Accordingly, though it operates outside of U.S. territory (over the high seas), Sea Launch must obtain a U.S. launch license because a license is required wherever a U.S. citizen or U.S. corporation launches outside the U.S., where the U.S. citizen or U.S. corporation has "controlling interest" (Carver, 24 Feb 05).

The financial responsibility review in step four is a key component of this licensing process. This component drives the insurance requirement for a corporation to demonstrate that it possesses either the financial reserves or is contracted for adequate insurance to compensate (make whole) "for maximum probable loss from claims of private parties for death, bodily injury and property damage/loss up to a maximum of $500 million liability; and from U.S. Government agencies for damage loss to government property up to a maximum of $100 million," (Carver, 24 Feb 05). This financial responsibility requirement is another mandate deriving ultimately from the Outer Space Treaty — specifically, Article VII—that states:

Each State Party to the Treaty that launches or procures the launching of an object into outer Space, including the Moon and other celestial bodies and each State Party from whose territory or facility an object is launched, is internationally liable for damage to another State Party to the Treaty or to its natural or its juridical persons by such object or its component parts on the Earth, in air Space or in outer Space, including the Moon and other celestial bodies.

The authorization to launch is inherent in the licensing process, and the compliance-monitoring component in step six provides for continuous supervision of the entity engaged in launch activities. These FAA licensing oversight measures ensure U.S. government compliance with Article VI of the Outer Space Treaty, but the treaty is not the only source of international law addressed by FAA licensing requirements.

"International Law recognizes a nation's jurisdiction over its citizens, its territory, territorial waters and airspace, and those ships and aircraft which it has registered," (Reynolds & Merges, 1997, p. 277). Implicit in this statement are not just the notion of responsibility, but also the idea of liability. The nation of registry or the "flagship" principle based on Customary International Law of the Sea mandates that only one nation can have sovereignty (or jurisdiction) over a vessel (considered a floating island or territory) on the high seas. Thus "liability" under the Law of the High Seas is tied to this one-state sovereignty principle. Much of Space law is analogous to international law governing the high seas. As a consequence, under the Liability Convention, determination of liability when multiple nations are involved in a Space launch starts with the definition of a launching state. "The term 'launching' includes attempted launching; the term 'launching state' means: a state which launches or procures the launching of a Space object; a state from whose territory or facility a Space object is launched," (http://www.un.or.at/OOSA/treat/lia/liatxt.html). Any state classified as a "launching state" is liable under the Liability Convention, and multiple states are "jointly and separately" liable. This term means states may be sued individually or collectively. (Carver, 20 Jan 05). If a suit were brought against Sea Launch, the likelihood is that the state with the best ability to pay would be the primary target of the suit. This would leave the United States as the primary target. Liability is apportioned between two categories under the Liability Convention: absolute and fault-based.

These two liability types are based on the locale of the incident. Absolute liability, also termed "strict liability," is based on the notion that activities in the air or on the ground with respect to Space operations are "ultra hazardous." Operations "necessarily involve a risk of serious harm to the person, land or chattels of others" and these activities are not a "matter of common usage," (Reynolds & Merges, 1997, p. 303). Accordingly, fault is irrelevant. As long as the nation is the "launching state," it will be liable for damages arising from the Space activity that occurs in the air or on the land. In contrast, fault-based liability, also termed "negligence," applies to incidents/accidents occurring in Space. In such cases, liability depends on who is deemed to be at fault.

Of course, Sea Launch and the notion of sea-based Space launching have both contributed to confusion over this idea of a "launching state." As one author notes:

Considering that when the Liability Convention was drafted, exploration and use of outer Space was [sic] within the capabilities of a few national governments and intergovernmental organizations, it is easy to understand that the advent of commercial consortia such as Sea Launch have [sic] inspired discussion and debate over the question: "which state is the launching state? (Schroeder, 2002)

Even so, though sea launches do not mute discussions about launching states, they do reduce liability implications for a given state because liability is more likely to be apportioned among all states engaged in the joint venture.

The increased demand for commercial Space launches has created an opportunity for the Space industry to prove that more efficient, cost-reducing approaches are possible. "Space as a frontier will never be developed by purely governmental activities. Though such activities are vital in the early stages, the real wealth creation will be by commercial forces," (Rowland, 1990, p. 45). The success of Sea Launch and other similar commercial Space ventures is fundamental to continued Space exploration and will serve as a catalyst for Space exploitation in the future.

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